

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

2521
R44A7

United States
Department of
Agriculture

c3

Agricultural
Research
Service

ARS-34

September 1985

1983 Virus Tolerance Ratings of Maize Genotypes Grown in Missouri

CURRENT SERIAL RECORDS

OCT 7 '85

USDA
NATIONAL AGRICULTURAL LIBRARY

ABSTRACT

CONTENTS

Wallin, J.R., and L.L. Darrah. 1985.
1983 Virus Tolerance Ratings of Maize
Genotypes Grown in Missouri. U.S.
Department of Agriculture, Agricultural
Research Service, ARS-34, 12 p.

Maize dwarf mosaic virus strain A (MDMV-A)
and maize chlorotic dwarf virus (MCDV)
were observed on maize plants at House
Springs, Mo. Forty-four commercial
hybrids, commonly grown in the southern
Corn Belt and rated for their response to
these 2 viruses, were tolerant, with no
significant differences among them. Forty
Zea diploperennis (diploid perennial
teosinte) x Corn Belt inbred populations
were evaluated and all showed tolerance to
the viruses, with no significant
differences among them. One hundred
thirty-two progeny selections from Iowa
State University rated a high level of
tolerance to the 2 viruses. Three other
populations plus the National White Maize
Variety Trial rated for their response
were all virus tolerant. The selections
of PRMo2, BS13, Ibadan Composite B, and
the 132 entries from Iowa State University
artificially inoculated with MDMV-A showed
a high degree of tolerance.

KEYWORDS: Aphids, leafhoppers, maize,
MCDV, MDMV, teosinte, white maize, Zea
diploperennis.

U.S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service
In Cooperation With
Missouri Agricultural Experiment Station

Copies of this publication may be
purchased from the National Technical
Information Service, 5285 Port Royal Road,
Springfield, VA 22161.

ARS has no additional copies for
distribution.

	Page
Virus incidence	1
Commercial hybrids	2
<u>Zea diploperennis</u> x inbred lines	2
Iowa State University, BS16(V)C-2 entries	2
PR-Mo2, BS13, and Ibadan Composite B selection trials	2
National White Maize Variety Trial (NWMVT)	3
Conclusions	3

EXCHANGE Rec'd

SEP 23 1985

1983 VIRUS TOLERANCE RATINGS OF MAIZE GENOTYPES GROWN IN MISSOURI

By J.R. Wallin and L.L. Darrah¹

This study identifies maize (Zea mays L.) genotypes evaluated in 1983 that exhibit various levels of tolerance to maize dwarf mosaic virus (MDMV) and maize chlorotic dwarf virus (MCDV). The results should be useful to growers for identifying hybrids with sufficient tolerance levels for planting in areas of high virus incidence. In addition, the results indicate new and experimental genotypes that might be useful as germplasm sources in maize improvement programs.

Commercial hybrids were grown at two locations in Missouri, and MDMV and MCDV symptoms were observed under conditions of natural infection. Trial plots were located on the Bonacker Farm near House Springs in Jefferson County and at the University of Missouri Delta Research and Extension Center at Portageville in Pemiscot County.

In 1983, materials for evaluation consisted of inbreds, S₁ lines, mass selected populations, and Zea diploperennis x Corn Belt inbred lines. Each entry was planted in single-row plots with 28 kernels per row. Rows were 6.1 m long and 91 cm apart. Three replications of a randomized complete block design were used for each trial unless otherwise indicated.

The Portageville and House Springs locations were planted late to encourage high levels of virus transmission from johnsongrass [Sorghum halepense (L.) Pers.], the alternate host. Johnsongrass is abundant and grows about 2 m high in and around trial plots at both

locations. The Portageville plot was planted on May 11, but was later abandoned because of drought. The House Springs plot was planted on June 1, 1983.

At the Rollins' Bottom nursery (University of Missouri) in Columbia, 4 replications of 80 entries of the PR-Mo2 population were planted on April 26. Plants were inoculated with MDMV-A using an artist's airbrush. Similarly, 3 replications of 60 entries of BS13 and 2 replications of 36 entries of Ibadan Composite B were inoculated with MDMV-A and rated.

At the Agronomy Research Center, east of Columbia, 2 replications of 132 entries of BS16-V from Iowa State University were planted on May 12. Plants were inoculated with MDMV-A on June 10 and rated on August 1, 1983.

Virus Incidence

Symptoms of both viruses were observed at Portageville and House Springs. MDMV produces a typical mosaic pattern, whereas MCDV produces vein clearing in infected leaves. Johnsongrass is the alternate host for both viruses. The corn leaf aphid [Rhopalosiphum maidis (Fitch)], the green bug [Schizaphis graminum (Rondani)], and many other aphids are vectors of MDMV, which can also be transmitted mechanically. The blackfaced leafhopper [Graminella nigrifrons (Forbes)] is the vector of MCDV, which cannot be transmitted mechanically.

Each plant was rated for virus symptoms on a severity scale of one to nine (1=no symptoms, 9=plant mortality). With the exception of the airbrush-inoculated plots, the ratings were made for severity of infection and not for specific virus symptoms. Plot means were then used for analyses of variance. The predominate virus at House Springs and Portageville was MDMV, which usually appears earlier than MCDV. The mean virus rating in 1983

¹ Respectively, research plant pathologist and research geneticist, Agricultural Research Service, U.S. Department of Agriculture, University of Missouri, Columbia, MO 65211.

at House Springs for the tolerant single-cross Mol4W x Oh7B was 2.96 (16-year mean=3.00) (table 1). The susceptible single-cross Mo5 x H55 rated 2.33 (16-year mean=6.51), which was considerably lower than 6.06, observed in 1982.

Commercial Hybrids

At House Springs, 44 commercial hybrids and 2 single-cross checks, 1 susceptible and 1 resistant, were planted for virus infestation. The lowest rating was 1.5 and the highest was 3.6 (table 2). No entry rated significantly better (lower rating) than the mean of all entries. Cargill Seeds 112885 (3.6) rated significantly higher than the mean and higher than any other entry.

Zea diploperennis x Inbred Lines

Thirty-two entries of diploid perennial teosinte x Mol7 backcrosses ([Zea diploperennis x popcorn) x Mol7] x Mol7) were planted on June 1 at House Springs and rated on August 16. Ratings for these entries ranged from 1.2 to 2.4, with no significant differences among entries. Eight diploid perennial teosinte x B73 backcrosses ([Zea diploperennis x popcorn) x B73] x B73) were evaluated. The ratings ranged from 1.3 to 2.1 and differences were not significant (table 3).

Iowa State University, BS16(V)C-2 Entries

One hundred thirty-two progeny selections were planted with 2 replications at House Springs for exposure to natural infection by MDMV and MCDV. Many of these entries rated 2.0 or less, which would indicate a high level of tolerance to the two viruses.

These same 132 selections were planted on May 12 in 2 replications at Columbia and inoculated with MDMV-A. The inoculum was obtained from Raymond Louie, USDA-ARS, Wooster, Ohio. Inoculations were made on

June 10 and rated on August 1. Most of these entries rated in the resistant category in both replications (2.5 or lower). Expressions of early symptoms indicated that a good infection was obtained.

PR-Mo2, BS13, and Ibadan Composite B Selection Trials

Progenies of these three populations were hand-inoculated with MDMV-A on June 7 at Rollins' Bottom, Columbia. Again, symptoms observed during early growth indicated good infection, and plants were rated on July 13-15.

PR-Mo2 representing five cycles of selection for virus tolerance plus another version of cycle selection for Stewart's wilt [Erwinia stewartii (E.F. Smith, 1898) Dye, 1963] tolerance were both included for virus ratings. The 32 entries selected for virus tolerance rated from 1.3 to 3.4. Differences among cycles were not significant. Most entries had ratings less than 2.0. The 20 entries of PR-Mo2 selected for Stewart's wilt tolerance also rated less than 2.0. Differences among entries were not significant. The same entries were planted at House Springs for natural infection with MDMV and MCDV. All entries rated less than 2.0 except one. Again, no significant differences among cycles were found.

Twenty progenies of the BS13 virus selection population were planted and hand-inoculated at Columbia. Ratings ranged from 1.1. to 4.0, and differences among progenies were not significant. The same progenies grown at House Springs rated similarly (1.8 to 4.9), with significant differences among entries. Predicted gain from selection was 1.5 percent per cycle.

The 18 progenies of Ibadan Composite B that had undergone virus selection rated from 1.7 to 3.2 at House Springs, but

differences among progenies were not significant. At Columbia, the same entries rated from 1.1 to 4.0 and differences were significant. Using the Columbia data, 6.9 percent gain per cycle was predicted for virus tolerance.

National White Maize Variety Trial (NWMVT)

The 1983 NWMVT was planted at House Springs, where it was subjected to a virus complex involving natural infection by MDMV and MCDV. All entries rated less than 2.0. However, the differences in virus severity among the genotypes were not significant.

Conclusions

Virus symptoms and the infection levels were only moderate in 1983. Because of extreme heat and drought from mid-July through August, all data taken at Portageville were discarded. Seemingly, the virus incidence was less in 1983 than in previous years at House Springs. This may have been due to excessive rainfall in the area during June; flooding occurring twice, which may have suppressed the early growth of johnsongrass, the alternate host; and insect vectors.

The commercial hybrids rated at House Springs were very virus tolerant. Statistical analyses revealed no progress from virus selection in PR-Mo2. Selections of PR-Mo2, PR-Mo2 x MoSQA, and PR-Mo2 x MoSQB were highly tolerant to both viruses at House Springs and to MDMV-A artificially inoculated at Columbia. Entries of Zea diploperennis backcrossed to both Mol7 and B73 were tolerant to MDMV and MCDV at House Springs. Most of the 132 selections of BS16(V)C-2 from Iowa State University were very tolerant to the 2 viruses in the House Springs plots and reacted likewise to artificial MDMV-A inoculation at Columbia. The 20 entries of BS13 inoculated at Columbia were tolerant, as

were most of the same entries in the House Springs trial. The 18 entries of Ibadan Composite B also proved to be virus tolerant at both locations.

A potential virus threat to dent corn (Zea mays indentata L.) exists wherever johnsongrass grows. Therefore corn growers and seed producers should select those hybrids with the highest levels of virus tolerance. Most of the commercial hybrids tested in 1983 had tolerance levels that should be considered adequate for planting in areas of high virus incidence.

Table 1.—Comparative mean virus ratings of tolerant and susceptible single crosses for virus infection for 16 years at House Springs, Mo.¹

Year	Mo14W x Oh7B (tolerant)	Mo5 x H55 (susceptible)
1968	1.67	8.00
1969	5.81	8.20
1970	4.00	7.30
1971	4.70	7.60
1972	2.33	7.00
1973	1.03	7.00
1974	3.60	8.20
1975	1.70	7.60
1976	4.00	6.80
1977	2.66	6.83
1978	3.17	5.08
1979	3.57	7.46
1980	3.29	5.79
1981	2.10	2.93
1982	1.46	6.06
1983	2.96	2.33
Mean	3.00	6.51

¹Rated on a scale from 1 (no symptoms) to 9 (dead plants).

Table 2.--Virus ratings of commercial hybrids evaluated at House Springs, Mo., 1983¹

Entry	No.	Virus rating (scale 1-9)
Golden Harvest EX 383	3	1.5
P-A-C SX17A	21	1.5
Funk's G-4740A	27	1.6
P-A-C Exp 112640	22	1.6
Ring Around 33831	46	1.6
Agrow 786044	35	1.7
Cargill 951	17	1.7
Cargill 206071	20	1.7
Northrup King PX95	40	1.7
P-A-C Exp 212542	23	1.7
Agrow 786368	33	1.8
Agrow 806172	34	1.8
Cargill 212544	18	1.8
DeKalb-Pfizer Genetics DK789 ...	43	1.8
DeKalb-Pfizer Genetics Exp 369	44	1.8
Golden Harvest EX 408	4	1.8
Golden Harvest XC905	15	1.8
Golden Harvest XC906	16	1.8
O's Gold 5255	30	1.8
Pioneer Brand 3187	7	1.8
Funk's 8006X	28	1.9
Funk's G-4734	29	1.9
McCurdy 81-34	11	1.9
McCurdy 8225	12	1.9
O's Gold 3344	29	1.9

See footnote at end of table.

Table 2.--Virus ratings of commercial hybrids evaluated at House Springs, Mo., 1983¹--Con.

Entry	No.	Virus rating (scale 1-9)
O's Gold 25943	31	1.9
Asgrow 796021	36	2.0
DeKalb-Pfizer Genetics XL728 ...	42	2.0
Golden Harvest EX 448	2	2.0
Golden Harvest EX 588	5	2.0
Golden Harvest H2660W	14	2.0
Golden Harvest H2745	13	2.0
O's Gold X2511	32	2.0
P-A-G Exp 112709	24	2.0
Pioneer Brand 3328	8	2.0
Ring Around RAX950	1	2.0
DeKalb-Pfizer Genetics Exp 370	45	2.1
McCurdy 7978	9	2.1
Northrup King PX79	39	2.1
Pioneer Brand 3147	6	2.1
Funk's 7007A	26	2.2
McCurdy 81-35	10	2.2
Mo5 x H55	38	2.3
Mol4W x Oh7B	37	2.3
Northrup King PX9692	41	2.3
Cargill 112885	<u>19</u>	<u>3.6</u>
Mean		1.9
LSD 0.055
CV%		17.1

¹Rated on a scale from 1 (no symptoms) to 9 (dead plants). Differences among entries were not significant.

Table 3.--Virus ratings of teosinte crosses evaluated at House Springs, Mo., 1983¹

Entry ²	No.	Virus rating (scale 1-9)
3922 Mol7 x (Pop x Mol7)	29	1.2
3897 (Cr x Mol7) (Cr x PR) x Mol7 ...	4	1.3
3899 B73 x (Pop x B73)	6	1.3
3911 (Mol7 x Cr) (Pop-Op) x Mol7	18	1.3
3923 Mol7 x (Pop x Mol7)	30	1.3
3898 B73 x (Pop x B73)	5	1.4
3903 (Cr x Mol7) (Cr x PR) x Mol7 ...	10	1.4
3913 (Mol7 x Pop) x Mol7	20	1.4
3920 (Pop x Mol7) x Mol7	27	1.4
218:1082 B73 x (Pop x B73)	39	1.4
3905 B73 x (Pop x B73)	12	1.5
3906 Mol7 x (Mol7 x Cr) (Pop-Op)	13	1.5
3909 Mol7 x (Cr x Mol7)(Cr x PR)	16	1.5
3912 (Mol7 x Pop) x Mol7	19	1.5
3916 (Mol7 x Teo) x Mol7	23	1.5
3928 (Mol7 x Pop) x Mol7	35	1.5
3908 Mol7 x (Cr x Mol7) (Cr x PR) ...	15	1.6
3896 (Cr x Mol7) (Cr x PR) x Mol7 ...	3	1.7
3900 Mol7 x (Cr x Mol7) (Cr x PR) ...	7	1.7
3901 Mol7 x (Cr x Mol7) (Cr x PR) ...	8	1.7
3902 (Cr x Mol7) (Cr x PR) x Mol7 ...	9	1.7
3907 Mol7 x (Mol7 x Cr) (Pop-Op)	14	1.7
3914 (Mol7 x Pop) x Mol7	21	1.7
3915 (Mol7 x Pop) x Mol7	22	1.7
3921 (Pop x Mol7) x Mol7	28	1.7
3924 (Mol7 x Pop) x Mol7	31	1.7
3930 (Mol7 x Pop) x Mol7	37	1.7

See footnotes at end of table.

Table 3.--Virus ratings of teosinte crosses evaluated at House Springs, Mo., 1983¹--Con.

Entry ²	No.	Virus rating (scale 1-9)
218:1051 B73 x (Pop x B73)	40	1.7
3910 (Mo17 x Cr) (Pop-Op) x Mo17	17	1.8
3918 (Mo17 x Teo) x Mo17	25	1.8
3925 (Mo17 x Pop) x Mo17	32	1.8
3895 B73 x (Pop x B73)	2	1.9
3917 (Mo17 x Teo) x Mo17	24	1.9
3919 (Mo17 x Teo) x Mo17	26	1.9
3926 (Mo17 x Pop) x Mo17	33	1.9
3904 B73 x (Pop x B73)	11	2.0
3894 B73 x (Pop x B73)	1	2.1
3929 (Mo17 x Pop) x Mo17	36	2.2
3927 (Mo17 x Pop) x Mo17	34	2.4
3931 (Mo17 x Pop) x Mo17	38	2.4
Mean		1.7
LSD 0.05		ns
CV%		19.9

¹Rated on a scale from 1 (no symptoms) to 9 (dead plants).

²Cr="Criollo," Pop="Popcorn x Zea diploperennis," Pop-Op="Open pollinated (popcorn x Zea diploperennis)," and Teo="Zea diploperennis."

